CLAIMS

The following claim listing will replace all prior versions, and listings, of claims in this application:

1. (Canceled).

2. (Previously presented) A process according to claim 30, wherein the ratio of branched:linear product from carbonylation process is greater than 1.5:1.

3. (Currently amended) A process for the carbonylation of vinyl ~~acetate~~ ester comprising reacting a vinyl ~~acetate~~ ester compound of formula (IV)

(IV)

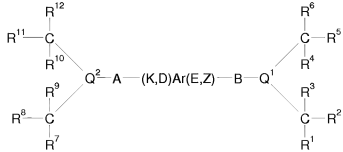
$$R^{29}C(O)\,O\,CR^{30}=CR^{31}\,R^{32}$$

wherein R^{29} may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27}, and $C(O)SR^{29}$ wherein R^{12}–R^{18} and R^{19}–R^{27} are as defined below and R^{30}–R^{32} independently represent hydrogen, lower alkyl, aryl or Het as defined herein, with carbon monoxide in the presence of a source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

(a) a metal of Group VIII B or a compound thereof; and

(b) a bidentate phosphine, arsine or stibine of formula (I)

(I)



wherein:

Ar is a bridging group comprising an optionally substituted aryl moiety to which the Q^1 and Q^2 atoms are linked on available adjacent carbon atoms;

A and B each independently represent lower alkylene;

K, D, E and Z are substituents of the aryl moiety (Ar) and each independently represent hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27}, $C(O)SR^{27}$, or $-J-Q^3(CR^{13}(R^{14})(R^{15}))CR^{16}(R^{17})(R^{18})$ where J represents lower alkylene; or two adjacent groups selected from K, Z, D and E together with the carbon atoms of the aryl ring to which they are attached form a further phenyl ring, which is optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)R^{25}R^{26}$, SR^{27} and $C(O)SR^{27}$ or, when Ar is a cyclopentadienyl group, Z may be represented by $-M(L_1)_n(L_2)_m$ and Z is connected via a metal ligand bond to the cyclopentadienyl group;

R^1 to R^{18} each independently represent lower alkyl, aryl, or Het;

R^{19} to R^{27} each independently represent hydrogen, lower alkyl, aryl, or Het;

M represents a Group VIB or VIIIB metal or metal cation thereof;

L_1 represents a cyclopentadienyl, indenyl or aryl group each of which groups are optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27}, $C(O)SR^{27}$ and ferrocenyl;

L_2 represents one or more ligands each of which are independently selected from hydrogen, lower alkyl, alkylaryl, halo, CO, $PR^{43}R^{44}R^{45}$ and $NR^{46}R^{47}R^{48}$;

R^{43} to R^{48} each independently represent hydrogen, lower alkyl, aryl, or Het;

n = 0 or 1;

and m = 0 to 5;

provided that when n = 1 then m equals 0, and when n equals 0 then m does not equal 0;

Q^1, Q^2 and Q^3 each independently represent phosphorus, arsenic or antimony.

4. (Canceled).

5. (Previously presented) A process according to claim 30, wherein the Group VIII B metal is palladium.

6. (Previously presented) A process according to claim 30, wherein the linear (n) and branched (iso) products of the carbonylation may be separated either before or after the step of chemically treating the product.

7. (Previously presented) A process according to claim 30, wherein the products of the reaction are separated by distillation.

8. (Previously presented) A process according to claim 30, wherein when K, D, E or Z represent –J–$Q^3(CR^{13}(R^{14})(R^{15}))CR^{16}(R^{17})(R^{18})$, the respective K, D, E or Z is on the aryl carbon adjacent the aryl carbon to which A or B is connected or, if not so adjacent, is adjacent a remaining K, D, E or Z group which itself represents –J–$Q^3(CR^{13}(R^{14})(R^{15}))CR^{16}(R^{17})(R^{18})$.

9. (Canceled)

10. (Previously presented) A process according to claim 30, wherein the carbon monoxide may be used in pure form or diluted with an inert gas

11. (Previously presented) A process according to claim 30, wherein the ratio (volume/volume) of vinyl acetate compound to hydroxyl group-containing compound lies in the range of 1:0.1 to 1:10.

12. (Previously presented) A process according to claim 30, wherein the amount of Group VIII B metal is in the range 10^{-7} to 10^{-1} moles per mole of vinyl acetate compound.

13. (Previously presented) A process according to claim 30, wherein the carbonylation of a vinyl acetate compound is performed in one or more aprotic solvents.

14. (Original) A process according to claim 13, wherein the aprotic solvent has a dielectric constant that is below 50 at 298.15 K and at $1x10^5$ Nm^{-2}.

15. (Previously presented) A process according to claim 30, wherein the catalyst compounds act as a heterogeneous catalyst.

16. (Previously presented) A process according to claim 30, wherein the catalyst compounds act as a homogeneous catalyst.

17. (Original) A process according to claim 15 wherein the process is carried out with the catalyst comprising a support.

18. (Original) A process according to claim 17, wherein the support is insoluble.

19. (Previously presented) A process according to claim 17, wherein the support comprises a polymer, a silicon compound, or other porous particulate material.

20. (Previously presented) A process according to claim 30, wherein the carbonylation is carried out at a temperature of between –10 and 150°C.

21. (Previously presented) A process according to claim 30, wherein the carbonylation is carried out at a CO partial pressure of between 0.80×10^5 $N.m^{-2}$ – 90×10^5 $N.m^{-2}$.

22. (Previously presented) A process according to claim 30, wherein the carbonylation is carried out at a low CO partial pressure of between 0.1 to 5×10^5 $N.m^{-2}$.

23. (Previously presented) A process according to claim 30, wherein the bidentate phosphine is independently selected from any of the following: bis (di-t-butyl phosphino)-o-xylene (also known as 1,2 bis (di-t-butylphosphinomethyl) benzene); 1,2 bis (diadamantylphosphinomethyl) benzene; 1,2 bis (diadamantylphosphinomethyl) naphthalene; 1,2 bis (di-t-pentyl phosphino)-o-xylene (also known as 1,2 bis (di-t-pentyl-phosphinomethyl) benzene); bis 2,3 (di-t-butyl phosphinomethyl) naphthalene; 1,2-bis-(ditertbutylphosphinomethyl) ferrocene; 1,2,3-tris-(ditertbutylphosphinomethyl) ferrocene; 1,2 bis (diadamantylphosphinomethyl) ferrocene; and 1,2 bis (di-t-pentyl phosphinomethyl) ferrocene.

24. (Canceled)

25. (Canceled)

26. (Canceled)

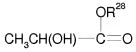
27. (Previously presented) A process according to claim 30, wherein chemically treating comprises hydrolysis or transesterification.

28. (Previously presented) A process according to claim 27, wherein chemically treating comprises hydrolysis and the product is hydrogenated subsequent to hydrolysis.

29. (Previously presented) A process according to claim 3 for producing mainly branched product.

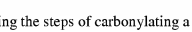
30. (Currently Amended) A process for the production of a lactate ester or acid of formula II

(II)



wherein R^{28} is selected from H and a C_1-C_{30} alkyl or aryl moiety which may be substituted or unsubstituted and either branched or linear,
comprising the steps of carbonylating a ~~acetate~~ ester compound of formula (IV)

(IV)

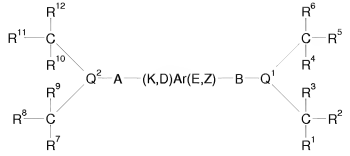


wherein R^{29} may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, SR^{27}, and $C(O)SR^{29}$ wherein R^{12}–R^{18} and R^{19}–R^{27} are as defined below, and R^{30}–R^{32} represent hydrogen, with carbon monoxide in the presence of a source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

(a) a metal of Group VIII B or a compound thereof; and

(b) a bidentate phosphine, arsine or stibine of formula (I)

(I)



wherein:

Ar is a bridging group comprising an optionally substituted aryl moiety to which the Q^1 and Q^2 atoms are linked on available adjacent carbon atoms;

A and B each independently represent lower alkylene;

K, D, E and Z are substituents of the aryl moiety (Ar) and each independently represent hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27}, $C(O)SR^{27}$, or $-J-Q^3(CR^{13}(R^{14})(R^{15}))CR^{16}(R^{17})(R^{18})$ where J represents lower alkylene; or two adjacent groups selected from K, Z, D and E together with the carbon atoms of the aryl ring to which they are attached form a further phenyl ring, which is optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27} and $C(O)SR^{27}$ or, when Ar is a cyclopentadienyl group, Z may be represented by $-M(L_1)_n(L_2)_m$ and Z is connected via a metal ligand bond to the cyclopentadienyl group;

R^1 to R^{18} each independently represent lower alkyl, aryl, or Het;

R^{19} to R^{27} each independently represent hydrogen, lower alkyl, aryl, or Het;

M represents a Group VIB or VIIIB metal or metal cation thereof;

L_1 represents a cyclopentadienyl, indenyl or aryl group each of which groups are optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27}, $C(O)SR^{27}$ and ferrocenyl;

L_2 represents one or more ligands each of which are independently selected from hydrogen, lower alkyl, alkylaryl, halo, CO, $PR^{43}R^{44}R^{45}$ and $NR^{46}R^{47}R^{48}$;

R^{43} to R^{48} each independently represent hydrogen, lower alkyl, aryl, Het;

n = 0 or 1;

and m = 0 to 5;

provided that when n = 1 then m equals 0, and when n equals 0 then m does not equal 0; and

Q^1, Q^2 and Q^3 each independently represent phosphorous, arsenic or antimony; to produce a product comprising a branched (iso) product and chemically treating said branched (iso) product to produce the corresponding lactate or acid of formula II.

31. (Currently Amended) A process for the production of a 3-hydroxy propanoate ester or acid of formula (III)

(III)

$$CH_2(OH)CH_2C(O)OR^{28}$$

wherein R^{28} is selected from H, and a C_1-C_{30} alkyl or aryl moiety which may be substituted or unsubstituted and either branched or linear,

comprising the steps of:

carbonylating a vinyl ~~acetate~~ ester compound of formula (IV)

(IV)

$$R^{29} - C(O)O\,CR^{30} = CR^{31}\,R^{32}$$

wherein R^{29} may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19}, $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27} and $C(O)SR^{29}$ wherein

R^{12}–R^{18} each independently represent lower alkyl, aryl, or Het;

R^{19} to R^{27} each independently represent hydrogen, lower alkyl, aryl, or Het;

and R^{30}–R^{32} represent hydrogen, with carbon monoxide in the presence of a source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

(a) a metal of Group VIII B or a compound thereof; and

(b) a bidentate phosphine, arsine or stibine of formula (I) in accordance with claim 30

to produce a product comprising a linear (n) product and chemically treating said linear (n) product to produce the 3-hydroxy propanoate ester or acid of formula (III).

32. (New) A process according to claim 30 wherein one or more of the groups R^1 to R^3, R^4 to R^6, R^7 to R^9, R^{10} to R^{12}, R^{13} to R^{15} or R^{16} to R^{18} together form a cyclic structure.

33. (New) A process according to claim 30 wherein one or more of the groups R^1–R^6 or R^7–R^{12} together form a cyclic structure.